Inter-University Upper Atmosphere Global Observation Network (IUGONET)

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IUGONET

Metadata DB for Upper Atmosphere

超高層大気長期変動の全球地上ネットワーク観測・研究

Inter-university Upper atmosphere Global Observation NETwork

JpGU Meeting 2012, Chiba (Japan), 23 May 2012

- U-01 Toward a New Framework of Global Data Activity -

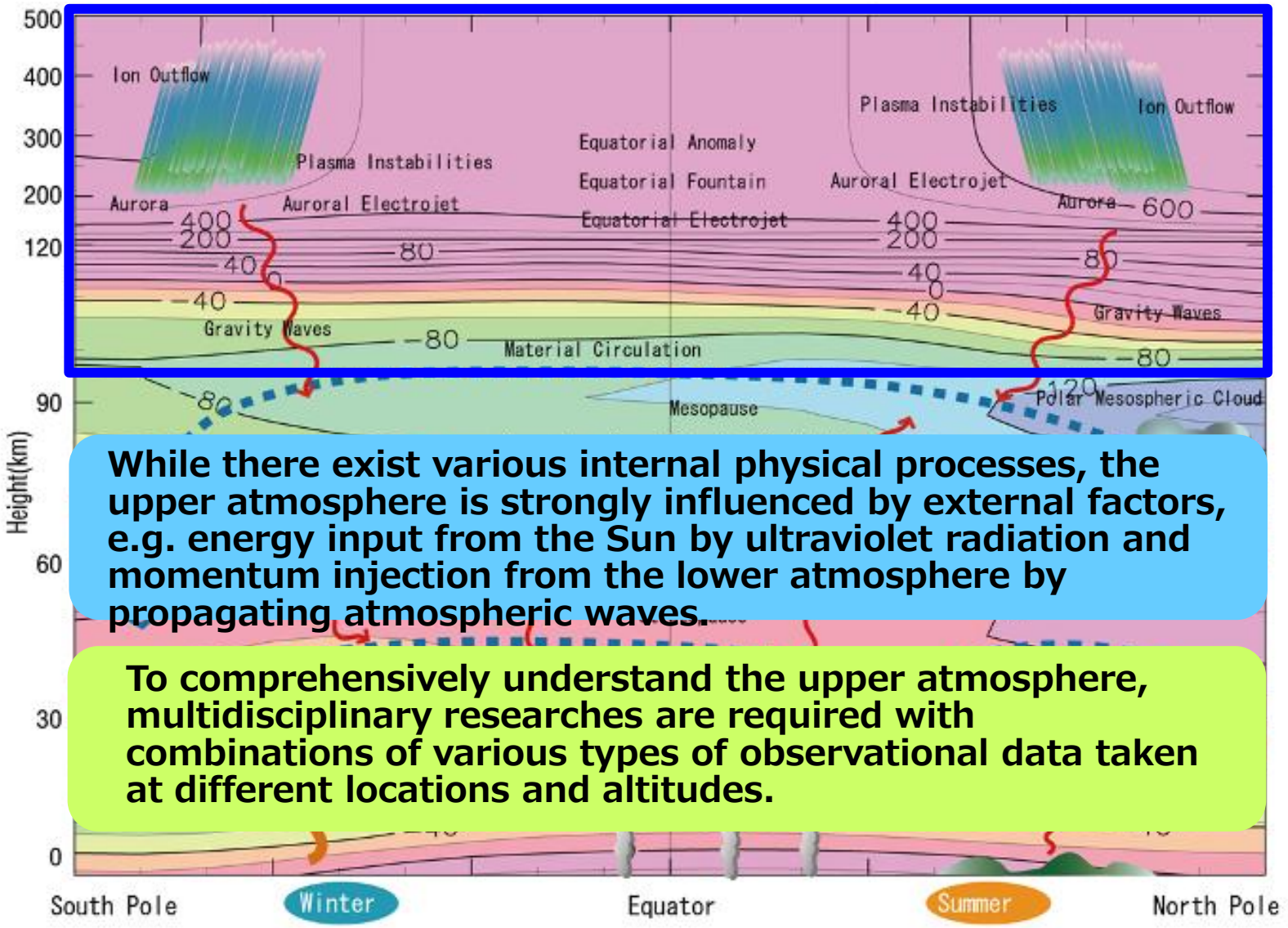
U01-06

Inter-University Upper Atmosphere Global Observation Network (IUGONET)

T. Tsuda, N. Sato, R. Fujii, T. Ono, K. Yumoto, T. Iyemori, T. Shibata, H. Hayashi, T. Hori, Y. Tanaka, Y. Koyama, S. Abe, A. Shinbori, N. Umemura, M. Yoneda, S. Ueno, N. Kaneda,

and IUGONET project team

Upper Atmosphere



While there exist various internal physical processes, the upper atmosphere is strongly influenced by external factors, e.g. energy input from the Sun by ultraviolet radiation and momentum injection from the lower atmosphere by propagating atmospheric waves.

To comprehensively understand the upper atmosphere, multidisciplinary researches are required with combinations of various types of observational data taken at different locations and altitudes.

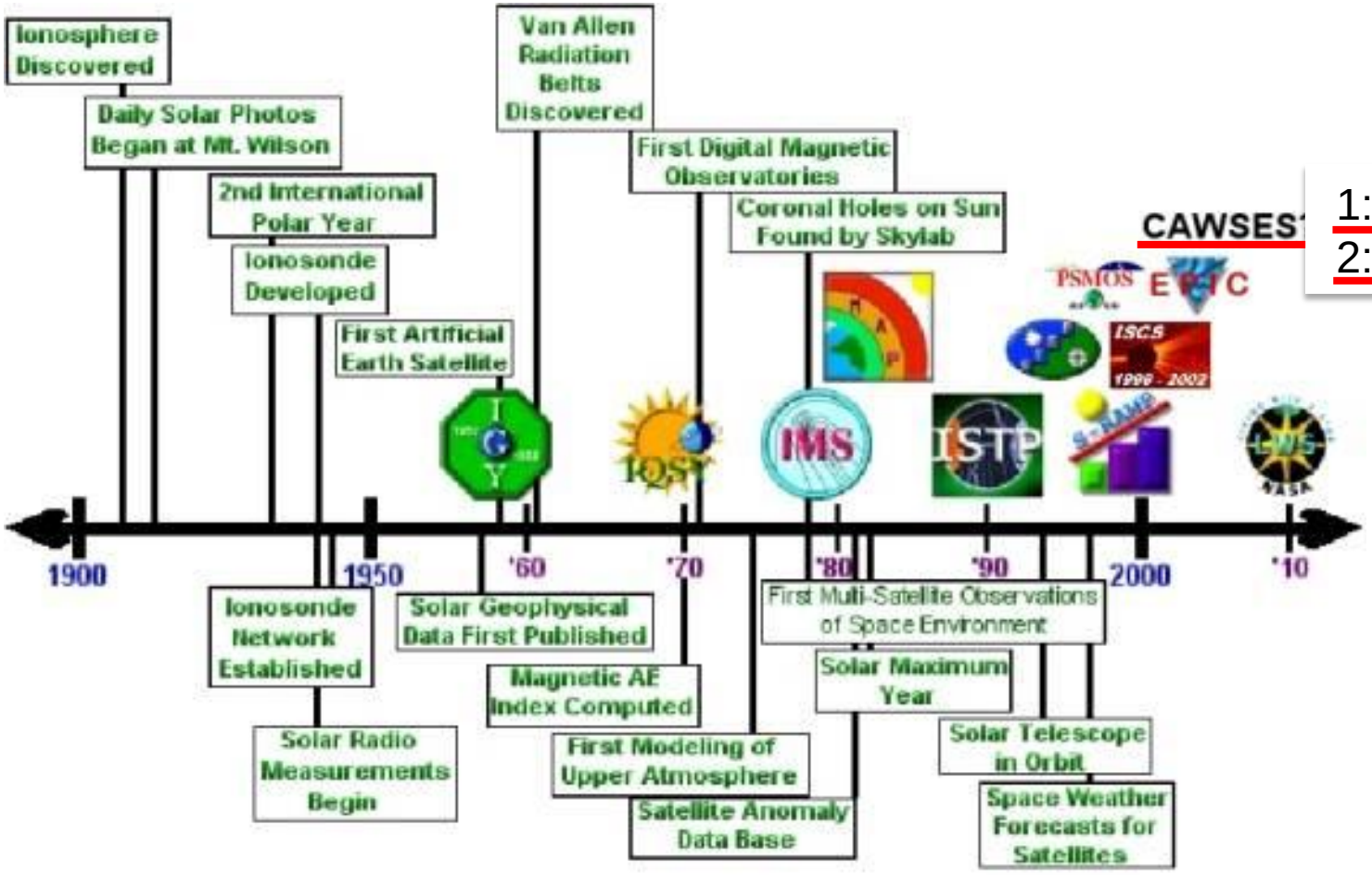
International Research Collaborations under ICSU

ICSU ------ Antarctic Research (SCAR)
- |--- Biodiversity (DIVERSITAS)
- |--- Climate Observation (GCOS)
- |--- Climate Research (WCRP)
- |--- Data for Science & Technology (CODATA)
- |--- Disaster Risk (IRDR)
- |--- Ecosystem Change & Society (PECS)
- |--- Geosphere-Biosphere (IGBP)
- |--- Human Dimensions of Global Environmental Change (IHDP)
- |--- Ocean Observations (GOOS)
- |--- Ocean Research (SCOR)
- |--- Radio Astronomy & Space Science (IUCAF)
- |--- Solar-Terrestrial Physics (SCOSTEP)

  President; Nat Gopalswamy (NASA)
  Vice President; F. J. Luebken, (IAP)
  Bureau from URSI, IAMAS, IAGA, IUPAP, SCAR, COSPAR

- |--- Space Research (COSPAR)
- |--- Terrestrial Observations (GTOS)
- |--- World Data System (WDS)

Historical Development of SCOSTEP Programs



1: 2004-2008
2: 2009-2013

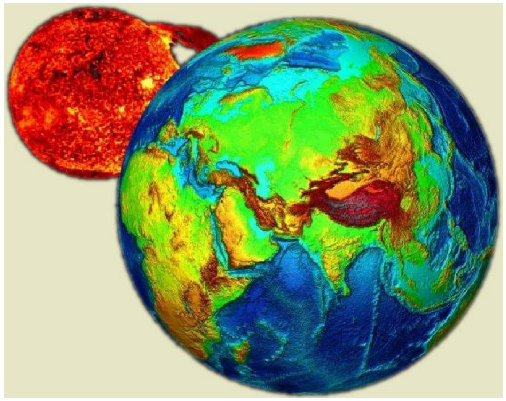
IGY: International Geophysical Year (1957/58)
IQSY: International Quiet Sun Year (1964/65)
IMS: International Magnetospheric Study (1976-79)
MAP: Middle Atmosphere Program (1982-85)
STEP: Solar-Terrestrial Energy Program (1990-95)

Post-STEP sub programs (1998-2002)

S-RAMP: STEP Results, Applications, and Modeling Phase
EPIC: Equatorial Processes Including Coupling
ISCS: International Solar Cycle Study
PSMOS: Planetary Scale Mesopause Observing System

CAWSES: Climate and Weather of the Sun-Earth System, 2004-2008

Climate
And
Weather of the **S**un-
Earth
System



SCOSTEP's international program in 2004-2008 to link the world's scientists in a cooperative effort to enhance our understanding of the Solar Terrestrial relations, which impacts on life and society. In particular, we put special emphasis on the short (weather) and long-term (climate) variability of the solar activities and their effects in geospace and Earth's environment.

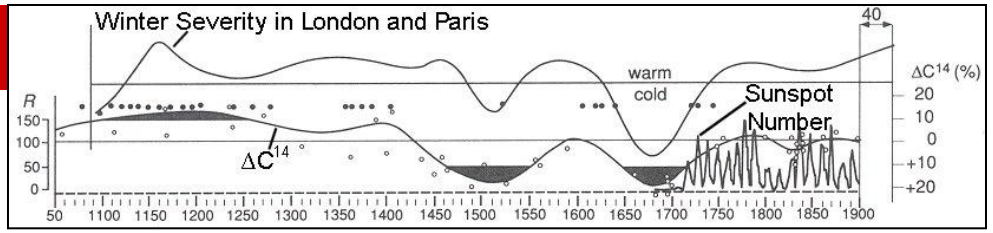
- **space missions, ground-based observations, and theory, modeling, and data analysis**
- **space weather forecasting, design of space- and Earth-based technological systems, and understanding the role of solar-terrestrial influences on global change.**

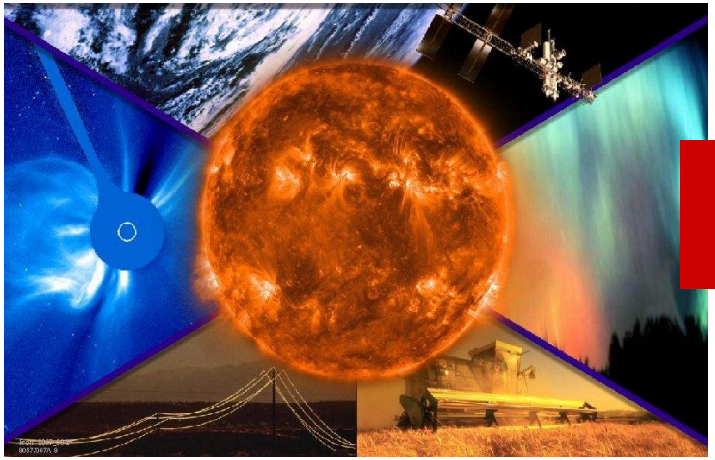
CAWSES Science Steering Group (SSG)

(1) Solar Influence on Climate
(2) Space Weather: Science and Applications
(3) Atmospheric Coupling Processes
(4) Space Climatology

Four Themes under CAWSES

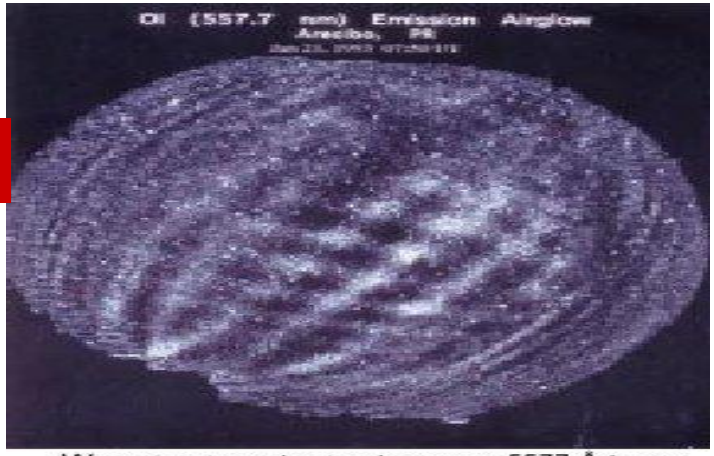
Solar Influence on Climate



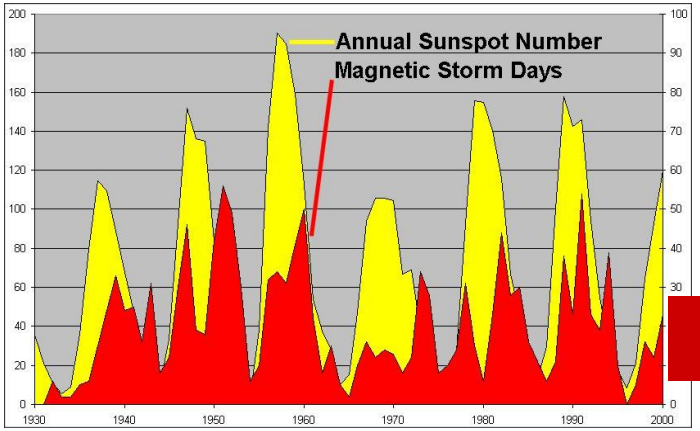


Space Weather: Science and Applications

Atmospheric Coupling Processes



Wave structures in atomic oxygen 5577 Å image.



Climatology of the Sun-Earth System

Ground-based observational data of upper atmosphere

For the ground-based observation of the upper atmosphere, huge, various kinds of observational data have been accumulated at universities and institutes since IGY in 1957-58.

These observational data have not been necessarily well used by various researchers.

IUGONET started in FY 2009!

CAWSES II: Towards Solar Maximum, 2009-2013

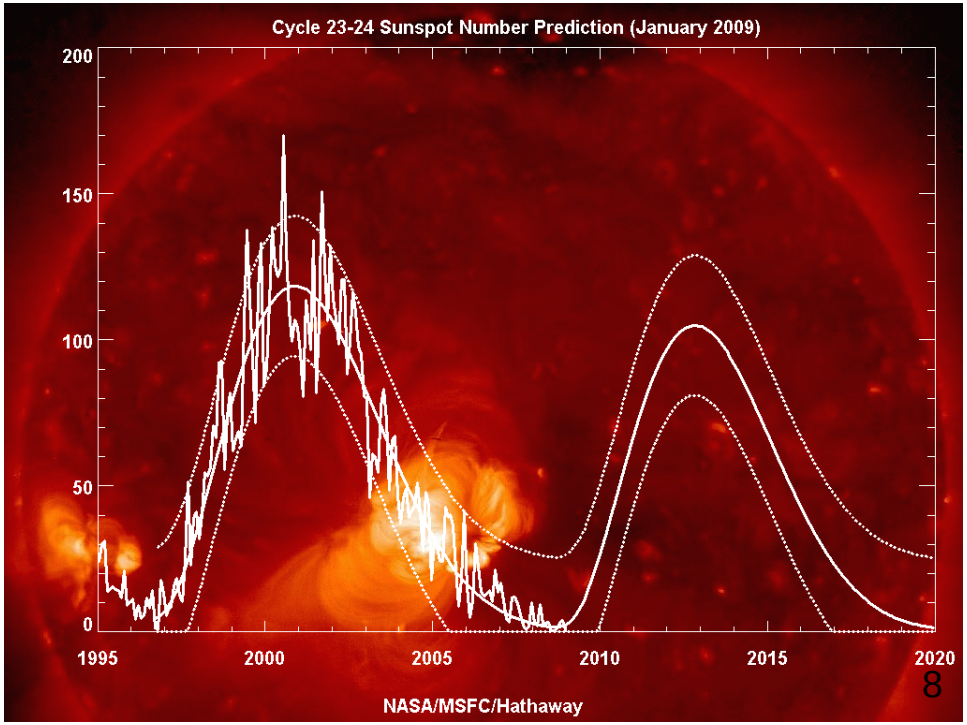
CAWSES II addresses:

- **Fundamental questions of how the coupled sun-earth system operates on timescales of minutes to millenia**
- **Questions that require coordinated inter-disciplinary international effort**

Co-Chair of CAWSES-II

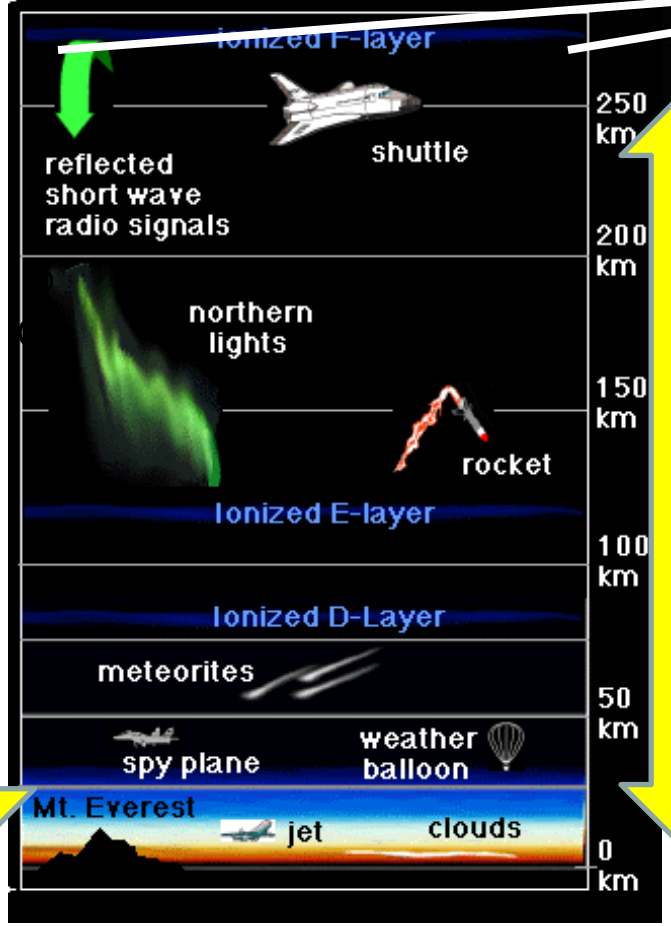
2009-10: Susan Avery & Alan Rogers

2011-13: Joe Davila & Toshitaka Tsuda



CAWSES task groups

TG1: Solar influences on climate



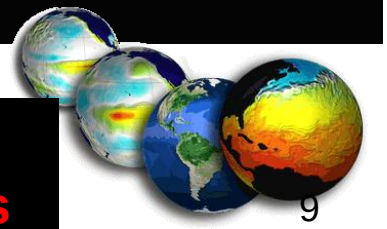
TG3: solar variability affects on geospace

TG2: Effect of climate change on geospace

TG4: Effect of waves on the upper atmosphere

TG5: Capacity building

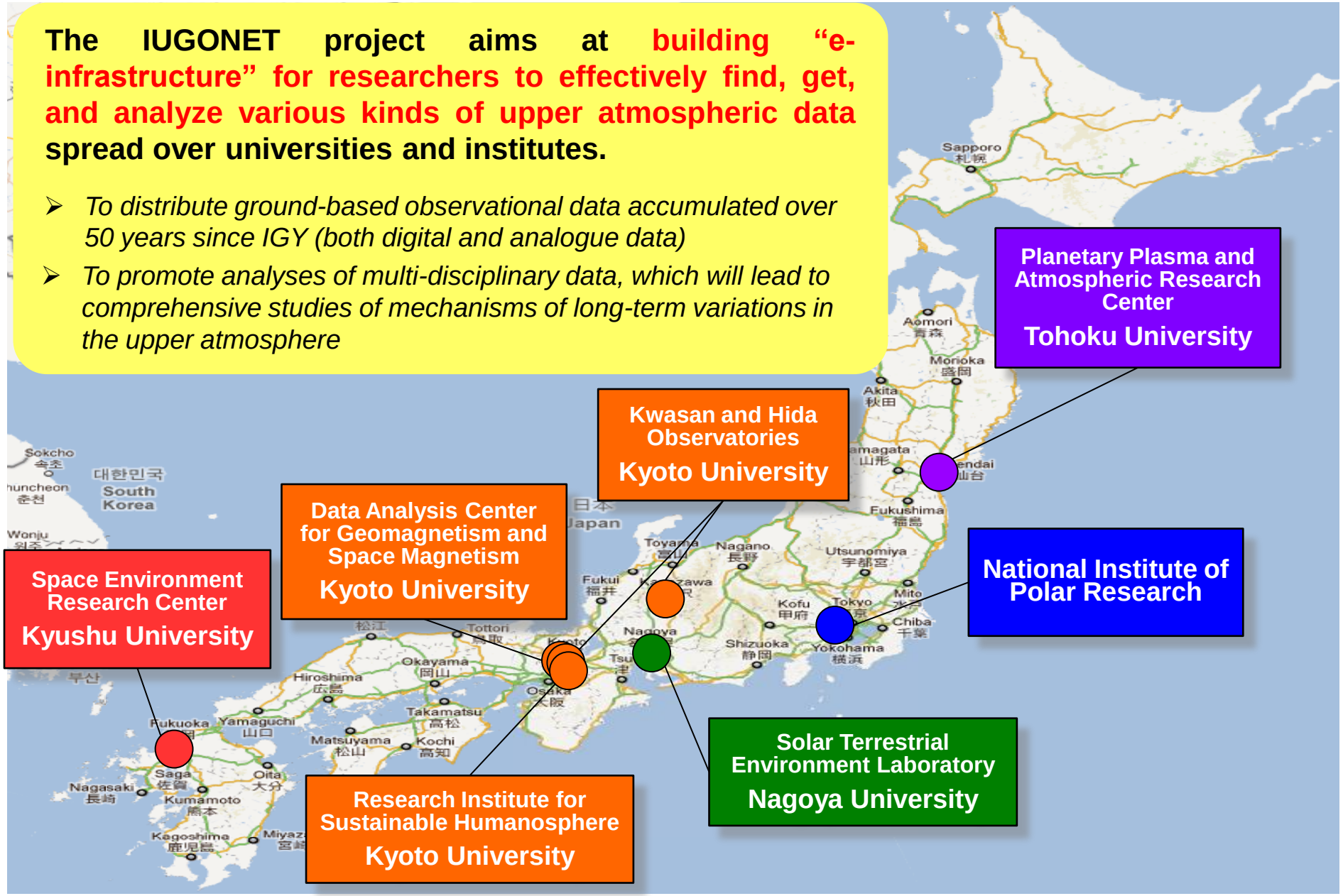
TG6: E-science and Informatics



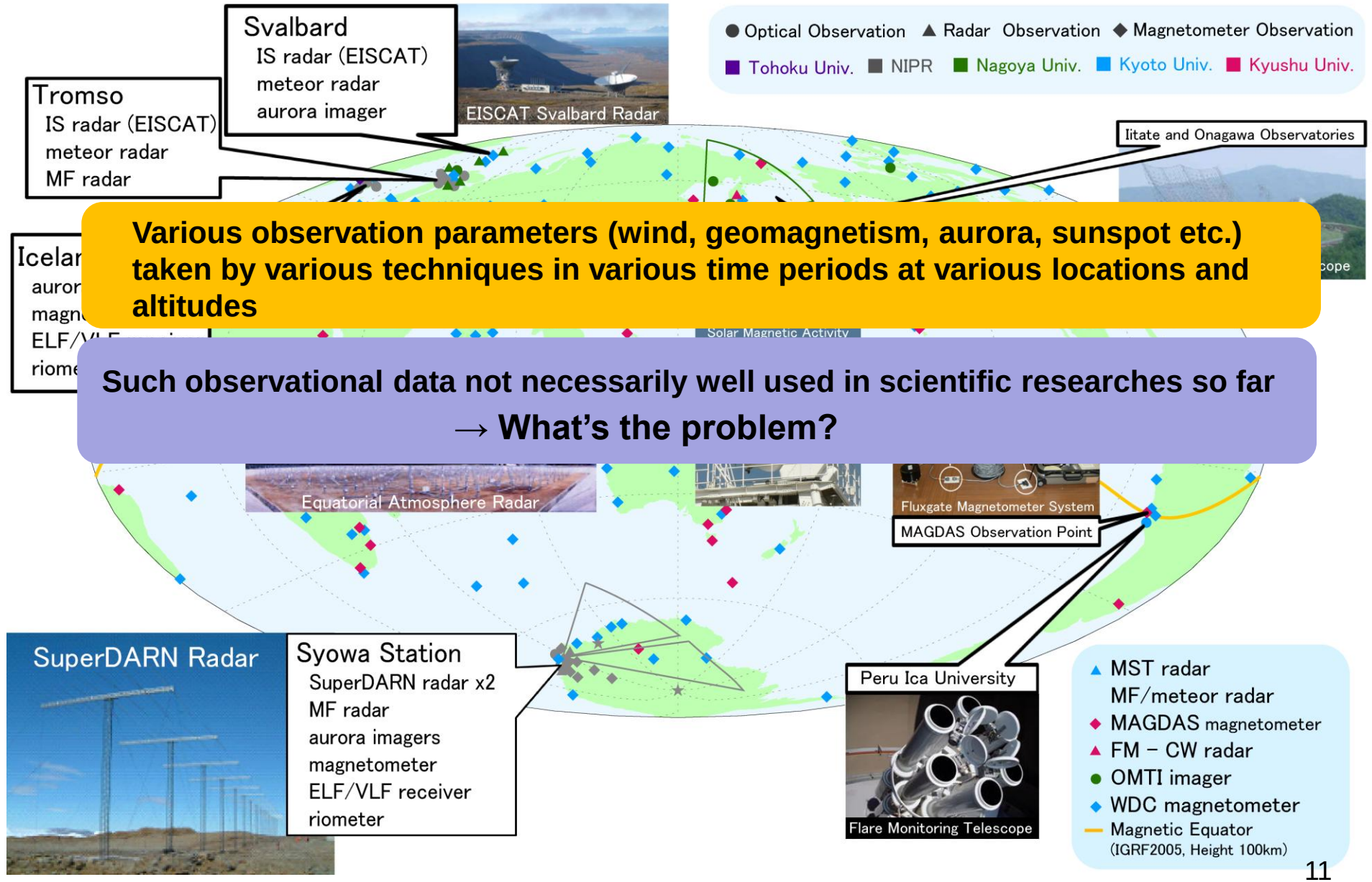
The IUGONET project - Objectives

The IUGONET project aims at building "e-infrastructure" for researchers to effectively find, get, and analyze various kinds of upper atmospheric data spread over universities and institutes.

- *To distribute ground-based observational data accumulated over 50 years since IGY (both digital and analogue data)*
- *To promote analyses of multi-disciplinary data, which will lead to comprehensive studies of mechanisms of long-term variations in the upper atmosphere*



Observational Data Collected by the IUGONET Institutes



京都大学 KYOTO UNIVERSITY

IUGONET

Schematic View of IUGONET Project

PROBLEM: Various kind, huge amount of data spread over research institutes with little info.

SOLUTION: Create a metadata database for cross-search of these dispersed data

Promote new types of the upper atmospheric research by the analysis of multidisciplinary data

Researchers in other institutes/universities in Japan and overseas

Strengthen collaboration among institutes/universities

Finally to other Earth and planetary science fields …

Expand this system to satellite and simulation data

Web

Geomagnetic research community

SERC, Kyushu Univ.

Magnetospheric research community

PPARC, Tohoku Univ.

Polar research community

National Institute of Polar Research

Geomagnetic research community

DACGSM, Kyoto Univ.

Ionospheric & magnetospheric research community

STE Lab, Nagoya Univ.

XML

Virtual Information Center for upper atmospheric sci.

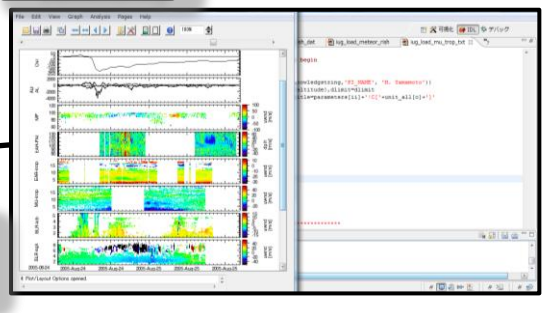
Create a metadata database of the upper atmospheric data for cross-search

Metadata DB

Kwasan & Hida Observarories, Kyoto Univ.

Solar physics research community

Develop an integrated data analysis software to handle the data from the IUGONET institutes



Obs. Database + Analysis Software

RISH, Kyoto Univ.

Equatorial atmosphere research community

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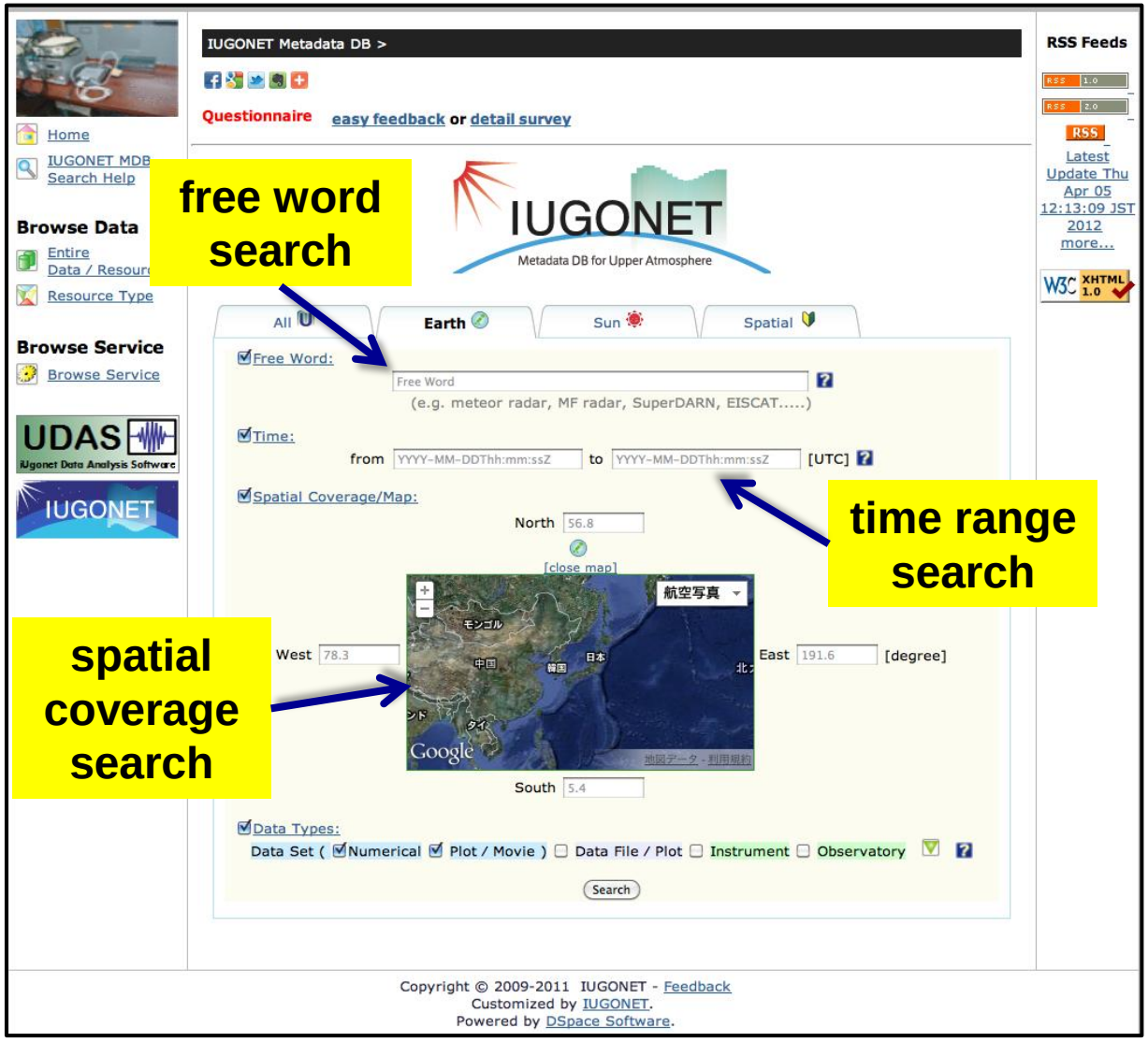
IUGONET Project Timeline

	ITEMS	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	REMARKS
Virtual Information Center	Installation & stable operation	Install system →	→	→	→	→	→	Construct the integrated research environment (video and/or web conference system, etc.)
	Extension to other disciplines						→	Wrap up the project and discuss further extension of the system to other discipline
Metadata DB system	Development	Make prototype →	Develop regular system →	Release product to public →				Design and build the IUGONET metadata DB system on the basis of DSpace
	Stable operation			→	Update computers →	→	→	Conduct regular operation of the metadata DB and customize it as needed
Metadata	Design of metadata format	Release ver.1 format →	Prepare documents →	Update the format as needed →	→	→	→	Formulate the IUGONET common metadata format and keep updating it if necessary
	Creation of metadata		→	Open metadata thru metadata DB →	Target relatively old, undatabased items →	→	→	Create metadata in the designated format and register them in the metadata DB system
Analysis Software	Survey & Specification of analysis software	Specification →	Prepare documents →					Design an integrated analysis software to download, visualize, and analyze data provided from the IUGONET institutions
	Programming		→	Release product to public →	Target relatively old, undatabased items →	→	→	Develop the IUGONET analysis software by using TDAS (a set of IDL subroutines)
Others	Rearrangement of observational DBs		Rearrange DBs corresponding to metadata & software development →	→	Arrange relatively old, undatabased items and digitize analogue data →	→	→	Rearrange existing observational DBs and newly set up DBs of undatabsed items
	Application to scientific researches			Conduct interdisciplinary researches by utilizing the IUGONET products →	→	→	→	Make a self-assessment of the IUGONET products and introduce how to use them in researches
	Outreach activities	Build project homepage →	→	Organize regular workshops and provide tutorial movies of the IUGONET products →	→	→	→	Conduct promotion activities to settle the IUGONET products as an essential e-infrastructure

Today

Development of metadata DB

http://search.iugonet.org/iugonet



# of metadata registered
(as of April 2012)

1.68 million

(* including metadata of data files)

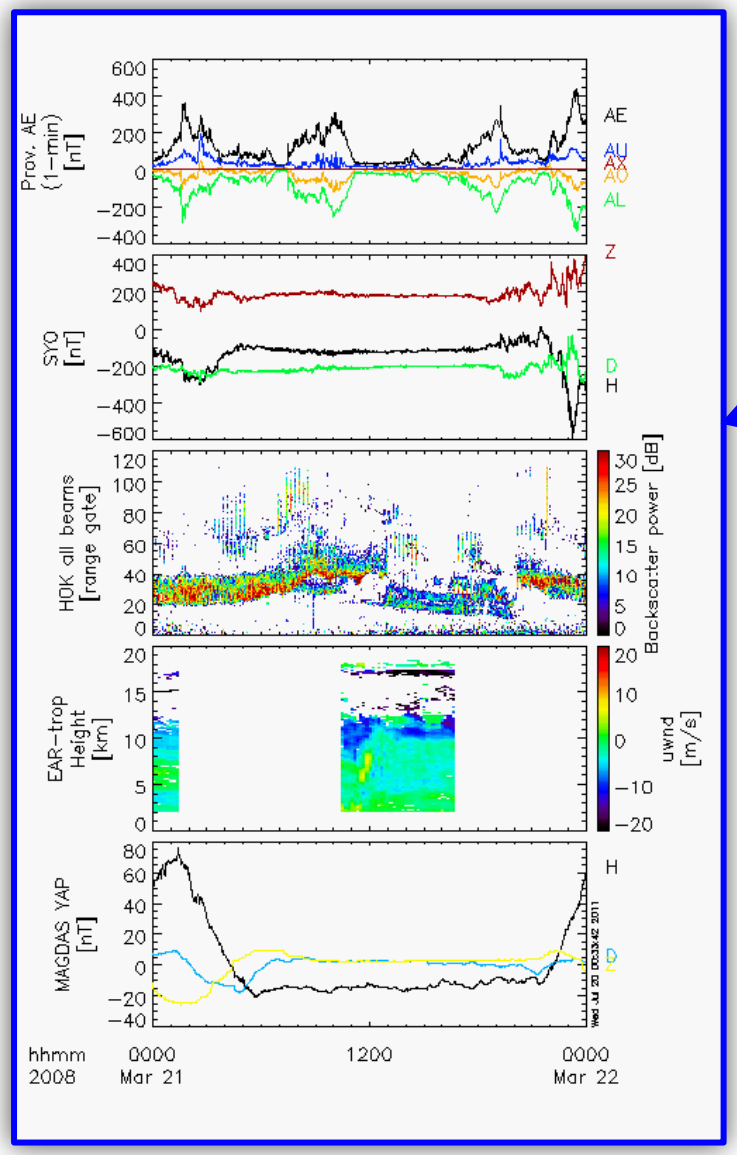
- **Metadata DB platform**

  DSpace - an open source software to manage digital contents and their metadata - with customization depending on our metadata

- **Metadata format**

  SPASE metadata model with some modifications according to characteristics of the ground-based observational data of the upper atmosphere

Development of Data Analysis Software

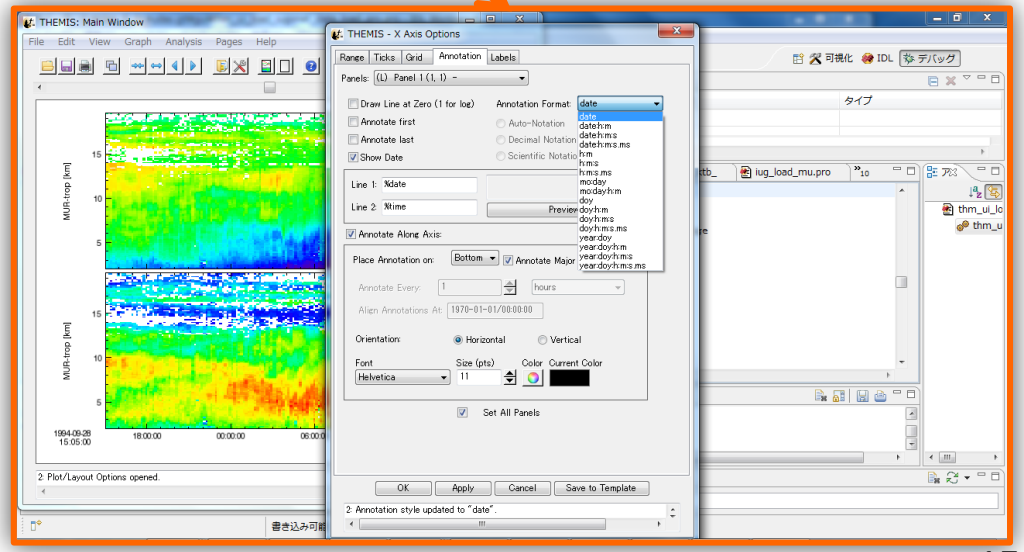


- ✓ **To help users easily download, visualize, and analyze various data provided from the IUGONET institutes**
- ✓ **With TDAS libraries in IDL**

THEMIS Data Analysis Software suite

Able to make stacked plots of time series to compare various kind of data

Easy to handle data by using GUI even for those who are not familiar with IDL



Outreach Activities

We are doing promotional activities to settle the IUGONET products as an essential e-infrastructure in the research communities.

● Data analysis workshop

We provide intensive course to learn how to use the IUGONET metadata DB & data analysis software and to analyze observational data provided by the IUGONET institutes

Next workshops

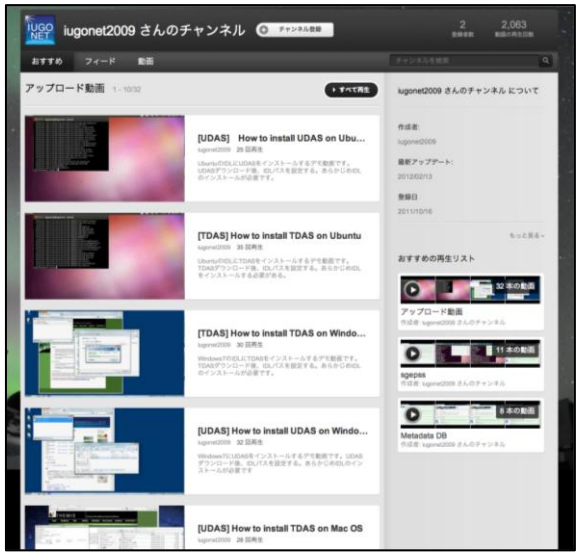
- **July or August 2012 @ Tachikawa**
- **February or March 2013 @ Nagoya**

Data analysis workshop @ Tachikawa (Jul 2011)

http://www.youtube.com/user/iugonet2009

● Online tutorial movies

Researchers can learn how to use IUGONET metadata DB & data analysis software anytime online at the IUGONET's YouTube site.



IUGONET Channel

Outreach Activities

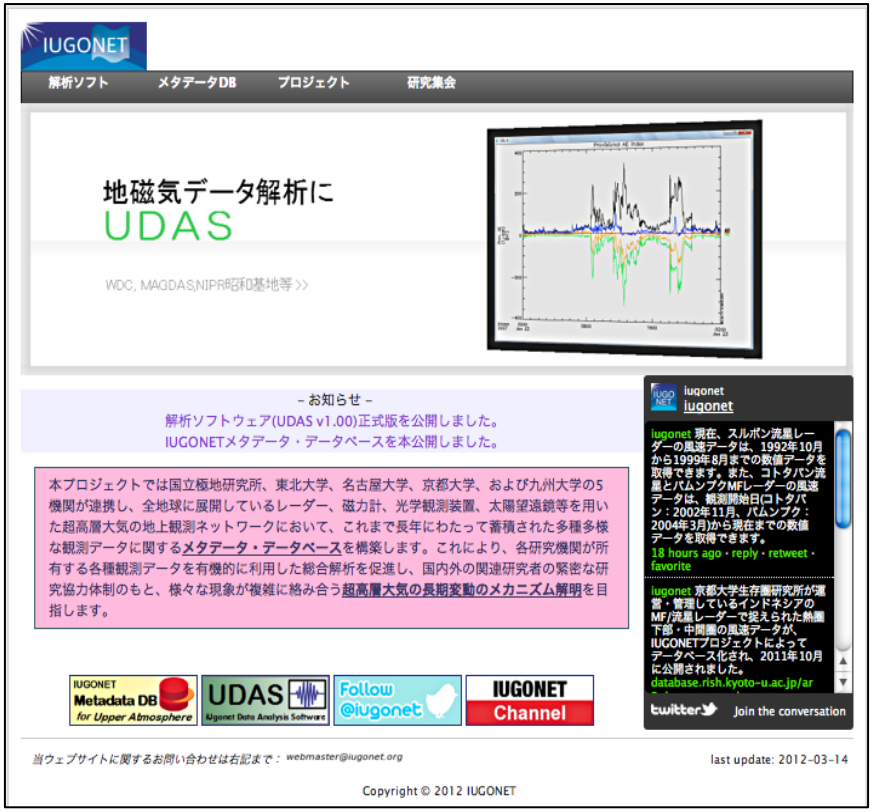
Follow @iugonet

http://twitter.com/#!/iugonet

Provide various information of metadata database, analysis software, data provided by each institute, meeting presentations, IUGONET workshop, etc.

IUGONET

http://www.iugonet.org/



Provide overview of the IUGONET project and its products

Summary

- **The IUGONET project (http://www.iugonet.org) builds metadata database and analysis software to promote effective distribution and use of upper atmospheric data taken by various ground-based observations.**

- **The IUGONET products have just been released!**

  Metadata database : **http://search.iugonet.org/iugonet/**

  Analysis software : **http://www.iugonet.org/en/software.html**

- **The IUGONET tries various promotional activities to settle the IUGONET products as an essential e-infrastructure in the research communities and plans to extend the products internationally and interdisciplinarily.**